making better BRANDY

Quality control in brandy production can be improved by measuring key quality parameters in the product. With a wide range of GC's and NIR analysers, Vinlab offers a comprehensive range of analysis on brandy and full-strength distillates for brandy production.

BRANDY BASICS

Base wine production

- Grapes are harvested between 18-21°Balling to achieve base wine alcohol levels of 9-12%.
- Clarified juice has been shown to result in higher levels of the main desired aromatic components in the distillate.
- No SO_2 should be added to the juice or wine. SO_2 is volatile and contributes negatively to the distillate. SO_2 may also corrode copper stills during distillation.
- Care should be taken to prevent unwanted microbiological spoilage in the absence of SO_2.
- MLF should be discouraged as it modifies positive aroma compounds. The MLF by-product, lactic acid, is the precursor of undesirable ethyl lactate.

Distillation

- Distillation should proceed soon after primary fermentation is complete.
- The presence of yeast lees in the base wine may increase levels of fruity esters in the distillate.
- Alcohol, higher alcohols, fermentation esters, fatty acids, and smaller amounts of other volatile components are concentrated in the distillate. Sugars, acids, proteins, tartrates and phenolics are not distilled.
- The heads and tails of the distillate are discarded as they contain undesirable volatile components and alcohol levels that are either too high or too low.
- The heart is the part that is used in brandy production and the alcohol content of the heart should be approximately 70%.

Maturation

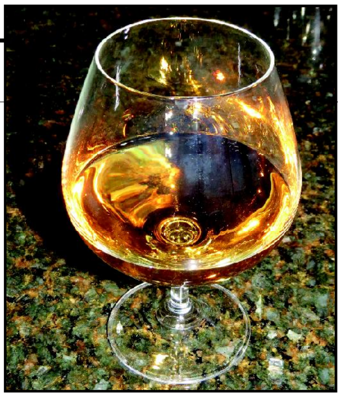
- After distillation the brandy is matured in oak barrels. During maturation colour and oak aroma compounds are extracted.
- Potstill brandy should be matured for at least three years in oak casks, and may be matured for as long as thirty years.
- Humidity levels in the maturation cellar are important. Higher levels of humidity are preferred as this results in a reduction in alcohol strength, rather than volume, by favouring the evaporation of ethanol over water. About 3% alcohol is lost every year. This reduction in alcohol strength softens the brandy. Drier environments allow for the evaporation of water and a decrease in volume, which results in a harsher tasting product.
- After maturation, the brandy is blended to achieve the specified style and diluted with pure water to reduce the alcohol to at least 38%

In addition to ethanol and obscuration, quality indicators which include methanol, acetaldehyde and the volatile constituents are analysed. The presence of these volatile compounds differentiates brandy from non-wine distillates, and the various concentrations of each will determine the individual brandy style.

BRANDY ANALYSIS

Methanol:
Methanol is toxic to humans, being oxidized to formic aldehyde and formic acid in the body. The maximum limit for methanol in distilled spirits is 2765mg/L in the U.S.A and 2000mg/L in the EU. However, most producers ensure that brandy contains significantly lower levels than this, and normal levels in undiluted distillates vary between 500 and 1000mg/L. At levels above 1200mg/L, methanol may have a negative effect on aroma and quality. Methanol has a low boiling point and distils mainly in the heads.

Acetaldehyde:
Acetaldehyde levels need to be controlled as higher levels can impart an undesirable aroma. The use of SO_2 in base wine production will lead to higher levels of acetaldehyde in the distillate.
Acetaldehyde distils mainly in the heads. Acceptable levels in undiluted distillate vary between producers, from 50 to 150mg/L.
Many producers will, however, employ distillation techniques to ensure that levels are lower than 10-20mg/L in the distillate. Oxidation reactions during maturation will result in the formation of further acetaldehyde. Levels in finished brandies vary between 50 and 300mg/L.



Higher alcohols:
Higher alcohols, or fusel oils, are alcohols with more than two carbons. They are by-products of yeast fermentation. Despite the fact that many of the individual higher alcohols have unpleasant aromas, in low concentrations they collectively add to brandy complexity. Their aromas have been described as spirit-like, spicy and pungent. Levels of total higher alcohols in the final matured brandy can give an indication of brandy style: 500-650mg/L for light brandies; 650-800mg/L for medium brandies; and > 800mg/L for full bodied brandies.
Isoamyl alcohol is the higher alcohol found in highest concentrations, with levels often greater than 1000mg/L in the undiluted distillate. Like the other higher alcohols, isoamyl alcohol and *active amyl alcohol* have unpleasant aromas, but still contribute to overall complexity. While some producers accept levels of isoamyl alcohol + active amyl alcohol up to 2000mg/L in the undiluted distillate, producers of high quality brandy may prefer to keep levels much lower.
1 Propanol and *isobutanol* are also found in relatively higher concentrations. They contribute to complexity, but can also be negative at higher levels. Acceptable levels for each compound are between 80 and 500mg/L in the undiluted distillate.
1- and 2-butanol are considered undesirable compounds and their individual levels should preferably be below 6mg/L in undiluted distillate. Some producers, however, accept levels of up to 15-20mg/L.

Higher alcohols analysed: 1-propanol; 2-butanol; 1-butanol; isobutanol; isoamyl alcohol; active amyl alcohol; 1-hexanol; 1-octanol; 2-phenyl ethanol.

Esters:
Esters play an important part in the overall aroma and flavor of brandy. Higher levels, up to 400mg/L, of total esters, excluding ethyl acetate, are preferred.
Although *ethyl acetate* is the most important ester, its levels need to be controlled as it contributes solvent and alcohol characters at higher levels. Higher levels usually indicate microbiological spoilage in the base wine. Small amounts of ethyl acetate contribute positively to overall aroma. Levels between 100 and 350-600mg/L are preferred in undiluted distillates. Ethyl acetate distills mainly in the heads section, and increasing the heads proportion of distillate will reduce the amount of ethyl acetate in the heart.
Ethyl lactate is the second most important ester. At higher levels it affects quality negatively, while at lower levels it contributes positively to overall aroma. Ethyl lactate levels will be higher when base wines have been through MLF. Levels between 30 and 200mg/L in the undiluted distillate are acceptable. Ethyl lactate is found mainly in the tails section, so cutting the heart timeously can decrease levels of ethyl lactate.
Ethyl butyrate is considered a spoilage ester, and may be used as a quality indicator. Levels above 10-15mg/L in the undiluted distillate negatively affect quality. The *longer chain esters* contribute positively to aroma and flavor and overall quality. They are associated with fruity and floral aromas. The amount of yeast lees present in the base wine can increase levels of these esters significantly. These esters include *ethyl hexanoate*, *ethyl octanoate* and *ethyl decanoate*. The longer chain ethyl esters distill over earlier in the distillation. Cutting the heads and tails, therefore, needs to be managed to optimize levels of both desirable and undesirable esters. *Isoamyl acetate* is another important ester. It contributes positively towards brandy flavor & has a fruity aroma.

Esters analysed: ethyl acetate; ethyl lactate; ethyl butyrate; ethyl formate; isobutyl acetate; isoamyl acetate; pentyl acetate; hexyl acetate; 2-phenylethyl acetate; ethyl hexanoate; ethyl octanoate; ethyl decanoate; diethyl succinate; ethyl laurate; ethyl myristate; ethyl palmitate.

Fatty acids:
The most important fatty acid is *acetic acid*, comprising up to 75% of the total fatty acids. The fatty acids have undesirable aromas and their concentrations should be limited. Acceptable levels for acetic acid in the undiluted distillate can range between 75-100mg/L, while total fatty acid levels should be less than 100-150mg/L.

Fatty acids analysed: acetic acid; propionic acid; isobutyric acid; butyric acid; isovaleric acid; hexanoic acid; octanoic acid; decanoic acid.

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